README Document for

AIRS Version 006 Products

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Revision History

Revision Date	Changes	Author
3/8/2013	Initial version	Thomas Hearty
9/9/2014	Added a reference to AIRG2SSD	Thomas Hearty
3/25/2015	Added section on the Level 1C product and modified CO2 release date.	Thomas Hearty

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Introduction

This README file applies to the Version 6 data products from the Atmospheric Infrared Sounder (AIRS) and contains basic information regarding the AIRS products. More extensive documentation (including all documents referenced in this README) is available from the AIRS documentation page at the Goddard Earth Sciences Data and Information Services Center (GES DISC). Documents specific to Version 6 are on the Version 6 Documentation page and documents specific to Version 5 are on the Version 5 Documentation page.

The V6 Data Release User Guide contains an overview of the instrument and all released data products. It also describes the suite of instruments which include the infrared spectrometer AIRS, a visible imager, and two microwave radiometers: the Advanced Microwave Sounding Unit (AMSU) and the Humidity Sounder for Brazil (HSB). We refer to this set of instruments as the AIRS Suite of Instruments.

The AIRS science team continues to improve the retrieval algorithm. At the end of each development cycle, a new version of the algorithm is delivered to the GES DISC for forward processing, as well as reprocessing of historical data. This document refers to data produced with Version 6 of the AIRS processing code. The changes from Version 5 are described in the Summary of Changes from Version 5 to Version 6 and a list of new file names, products, liens, and data outages are provided in the AIRS/AMSU/HSB Version 6 Data Disclaimer . Descriptions of all the released Version 6 products can be found in the Version 6 Processing Files Description.

Section 1 of this README describes the different AIRS products. Briefly, the Level 1b data files are HDF-EOS (based on HDF version 4) swath format containing the geolocated, calibrated radiances at the instrument spatial resolution. Since the Version 6 algorithm continues to use Version 5 radiance data all documentation concerning radiance data for the AIRS Suite of Instruments is on the Version 5 documentation page. The Level 2 data files are also HDF-EOS swath format containing the retrieved geophysical variables in the satellite reference frame. The Level 3 data files are HDF-EOS grid format containing the retrieved geophysical variables averaged onto a uniform 1°x1° deg lat/lon grid. There are 3 Version 6 processing streams of each Level 2 and Level 3 data type that differ based on the combination of instrument radiances from the AIRS Suite used in the retrieval process. We refer to each of these processing streams

as a different "flavor" of Version 6 products. The main V6 product (or flavor) is the retrieval based on the combined AIRS and AMSU observations. Another is based on the combined AIRS, AMSU, and HSB observations. Since the HSB instrument stopped working very early in the mission (February 2003) the AIRS+AMSU+HSB retrieval is the shortest time series of the three flavors. A third flavor is the AIRS-Only retrieval that does not use any microwave data. The AIRS-only algorithm is a backup algorithm that provides a continuous data product over the entire mission in the event that the AMSU instrument fails.

Images showing the locations of the Level 1b and Level 2 data files (granules) on the Earth for every day of the mission from start to current date are available at the link

http://disc.sci.gsfc.nasa.gov/daac-bin/airs/airs_gallery.pl

Section 2 describes the organization of the data files, the file naming convention, the file format and structure, and the file contents. Section 3 describes where to find the tools and services for AIRS that are available from the Goddard Earth Sciences Data and Information Services Center. Section 4 lists links to more information about AIRS.

AIRS Products

Level 1B Products

The AIRS Level 1B Product Generation Executives (PGEs) produce 6 minute "granules" (generally 240/day) of calibrated, geolocated radiances. The exception is the AIRXBCAL subset that is produced once per day. Table 1 lists the Level 1b product files by shortname. There is a separate Level 1B file for each of the instruments from the AIRS suite as well as a quality assurance subset for the infrared and visible instruments and the daily calibration subset. Since the AIRS Version 6 retrieval code continues to use the Version 5 radiance data the Level 1b documentation is located on the AIRS Version 5 Documentation page.

Table 1 AIRS Suite Level 1B Products

Product Short Name	Product Type Filename String	Description
AIRIBRAD	AIRS_Rad	AIRS IR geolocated & calibrated radiances
AIRVBRAD	VIS_Rad	AIRS Vis/Near IR geolocated and calibrated radiances
AIRABRAD	AMSU_Rad	AMSU-A1 & AMSU-A2 geolocated, & Calibrated brightness temperatures
AIRHBRAD	HSB_Rad	HSB geolocated & calibrated brightness HSB geolocated and calibrated brightness temperatures
AIRIBQAP	AIRS_QaSub	AIRS IR quality assurance subset
AIRVBQAP	VIS_QaSub	AIRS Vis/Near IR quality assurance subset
AIRXBCAL	Cal_Subset	L1B Calibration subset for AIRS IR, Vis/NIR, and AMSU-A

Level 1C Product

The Level 1C radiance product (

Table 2) was first introduced in Version 6. Unlike all other routine products, the Level 1C files are only stored for 30 days. The Level 1C has the same granularity as the Level 1B product (generally 240/day), however, it includes some enhancements. Additional details about this product are available in the AIRS_L1C_UserGuide.pdf.

Table 2 AIRS Level 1C Product

Product Short Name	Product Type Filename String	Description
AIRICRAD	AIRS_Rad	AIRS IR geolocated & calibrated radiances with corrections for instrument artifacts caused by calibration errors, bad channels, spectral shifts, spectra gaps and spectral overlaps

Level 2 Products

There are three types of AIRS Level 2 product files: The *standard*, *support*, and *cloud cleared radiance* files. For each of these types of files the version 6 PGE produces what we call three "flavors" of AIRS Level 2 standard products that differ only in the combination of instrument radiances used in the retrieval process. All Level 2 documentation is available on the AIRS Version 6 Documentation page. The user is encouraged to read the V6_L2_Product_User_Guide, the V6_L2_Quality_Control_and_Error_Estimation,and the V6_L2_Performance_and_Test_Report documents.

Level 2 Standard Products

As for the Level 1b products, there are generally 240 six minute granules per day of retrieved geophysical variables of temperature, water vapor, clouds, and trace gases. Table 3 lists the Level 2 standard product files by shortname.

Table 3 Three Flavors of the AIRS Level 2 Standard Products

Product Short Name	Product Type Filename String	Description
AIRX2RET	RetStd	Level-2 retrieval product crated using AIRS IR, AMSU without-HSB
AIRH2RET	RetStd_H	Level-2 retrieval product created using AIRS IR, AMSU and HSB
AIRS2RET	RetStd_IR	Level-2 retrieval product crated using AIRS IR-Only

Level 2 Support Products

The AIRS Level 2 Support product files (240 per day) are much larger than the standard files and contain additional variables that are too large for the standard files (e.g., 100 temperature levels rather than the 28 in the standard files) or have not been rigorously validated. The Level 2 Support files have the same three flavors as the standard files which depend on the retrieval process. Table 4 lists the Level 2 support product files by shortname.

Table 4 Three Flavors of the AIRS Level 2 Support Products

Product Short Name	Product Type Filename String	Description
AIRX2SUP	RetSup	Level-2 retrieval support product created using AIRS IR, AMSU without-HSB
AIRH2SUP	RetSup_H	Level-2 retrieval support product created using AIRS IR, AMSU and HSB
AIRS2SUP	RetSup_IR	Level-2 retrieval support product created using AIRS IR-Only

Level 2 Cloud Cleared Radiance Products

The Cloud-Cleared IR Radiance product is derived from the retrieved atmospheric state and contains calibrated, geolocated infrared radiances (milliWatts/m^2/cm^{-1}/steradian) for each AIRS channel that would have been observed within each Advanced Microwave Sounding Unit (AMSU) footprint if there were no clouds in the Field of View. They are an order of magnitude larger in data volume than the Standard Products and many Standard Product users are expected to have little interest in the Cloud Cleared Radiances. Therefore they are in a separate output file. Table 5 lists the Level 2 cloud-cleared radiance product files by shortname.

Table 5 Three Flavors of the AIRS Level 2 Cloud Cleared Radiance Products

Product Short Name	Product Type Filename String	Description
AIRICCF	CC	Level-2 cloud cleared radiance product created using AIRS IR, AMSU without-HSB
AIRHCCF	CC_H	Level-2 cloud cleared radiance product created using AIRS IR, AMSU and HSB
AIRSCCF	CC_IR	Level-2 cloud cleared radiance product created using AIRS IR-Only

Level 3 Products

The AIRS Level 3 products contain gridded statistical summaries of the of the AIRS geophysical variables. Additional details about these products are described in the AIRS/AMSU/HSB Version 6 Level 3 Product User Guide which described the Level 3 Standard, Support, and Research products and the AIRS/AMSU/HSB Version 6 Level 3 Quantization Product Quick Start that described the Quantization products.

Level 3 Standard Products

Level 3 Standard Gridded products are produced from the standard retrieval and include means, standard deviations and input counts of the retrieved geophysical variables on a 1° by 1° grid.

The Level 3 products are averaged over daily, 8-day, and monthly time spans for each of the three flavors of Level2 products. Table 6 lists the Level 3 standard product files by shortname.

Table 6 AIRS Level 3 Standard Products

Product Short Name	Product Type Filename String	Description
Daily		
AIRX3STD	RetStd001	L3 daily gridded standard retrieval product using AIRS IR and AMSU, without-HSB
AIRH3STD	RetStd_H001	L3 daily gridded standard retrieval product using AIRS IR and AMSU, with-HSB
AIRS3STD	RetStd_IR001	L3 daily gridded standard retrieval product using AIRS IR-Only
8-day		
AIRX3ST8	RetStd008	L3 eight day gridded standard retrieval product using AIRS IR and AMSU, without-HSB
AIRH3ST8	RetStd_H008	L3 eight day gridded standard retrieval product using AIRS IR and AMSU, with-HSB
AIRS3ST8	RetStd_IR008	L3 eight day gridded standard retrieval product using AIRS IR-Only
Monthly		
AIRX3STM	RetStd028- RetStd031 (depending upon the month)	L3 monthly gridded standard retrieval product using AIRS IR and AMSU, without-HSB
AIRH3STM	RetStd_H028-RetStd_H031 (depending upon the month)	L3 monthly gridded standard retrieval product using AIRS IR and AMSU, with-HSB
AIRS3STM	RetStd_IR028-RetStd_IR031 (depending upon the month)	L3 monthly gridded standard retrieval product using AIRS IR-Only

Level 3 Support Products

Level 3 Support Gridded products are similar to the Level 3 Standard products except that they include means, standard deviations and input counts of the retrieved geophysical at 100 levels and it included intermediate or no fully validated variables. The Level 3 support products are averaged over daily, 8-day, and monthly time spans for each of the three flavors of Level2 products. Table 7 lists the Level 3 support product files by shortname.

Table 7 AIRS Level 3 Support Products

Product Short Name	Product Type Filename String	Description
Daily		
AIRX3SPD	RetSpd001	L3 daily gridded support retrieval product using AIRS IR and AMSU, without-HSB
AIRH3SPD	RetSpd_H001	L3 daily gridded support retrieval product using AIRS IR and AMSU, with-HSB
AIRS3SPD	RetSpd_IR001	L3 daily gridded support retrieval product using AIRS IR-Only
8-day		
AIRX3SP8	RetSpd008	L3 eight day gridded support retrieval product using AIRS IR and AMSU, without-HSB
AIRH3SP8	RetSpd_H008	L3 eight day gridded support retrieval product using AIRS IR and AMSU, with-HSB
AIRS3SP8	RetSpd_IR008	L3 eight day gridded support retrieval product using AIRS IR-Only
Monthly		
AIRX3SPM	RetSpd028- RetSpd031 (depending upon the month)	L3 monthly gridded support retrieval product using AIRS IR and AMSU, without-HSB
AIRH3SPM	RetSpd_H028-RetSpd_H031 (depending upon the month)	L3 monthly gridded support retrieval product using AIRS IR and AMSU, with-HSB
AIRS3SPM	RetSpd_IR028-RetSpd_IR031 (depending upon the month)	L3 monthly gridded support retrieval product using AIRS IR-Only

Level 3 Quantization Products

The AIRS quantization products are distributional summaries derived from the Level-2 standard retrieval products (of swath type). The primary aim of the quantization products is to provide a more comprehensive set of statistical summaries than the traditional means and standard deviation. They preserve the multivariate distributional features of the original data and so provide a compressed data set that more accurately describes the disparate atmospheric states in the original Level-2 swath data set. The quantized products listed in Table 8 provide statistics on a 5°X5° grid over 8-day and monthly time spans for each of the three flavors of Level 2 products.

Table 8 AIRS Level 3 Quantization Products

Product Short Name	Product Type Filename String	Description
5-day		
AIRX3QP5	RetQuant005	Level-3 quantization product created using AIRS IR, AMSU, without-HSB
AIRH3QP5	RetQuant_H005	Level-3 quantization product created using AIRS IR, AMSU, and-HSB
AIRS3QP5	RetQuant_IR005	Level-3 quantization product created using AIRS IR-Only
Monthly		
AIRX3QPM	RetQuant028-RetQuant031 (depending upon the month)	Level-3 quantization product created using AIRS IR, AMSU, without-HSB
AIRH3QPM	RetQuant_H028-RetQuant_H031 (depending upon the month)	Level-3 quantization product created using AIRS IR, AMSU, and-HSB
AIRS3QPM	RetQuant_IR028-RetQuant_IR031 (depending upon the month)	Level-3 quantization product created using AIRS IR-Only

AIRS Near Real Time Products

The AIRS Near Real Time (NRT) products are available for Level-1B and Level-2 and stored on a rolling archive for 7 days. The AIRS NRT products only produced for the AIRS+AMSU flavor and the NRT product files are listed by shortname in Table 9. Access to the AIRS NRT data is free but requires prior user registration. AIRS NRT products are produced by the same core science algorithms as in the routine science data production, but using predicted ephemeris in place of definitive ephemeris and the NRT processing proceeds whether or not the previous or subsequent Level 1b granules are present or whether the forecast surface pressure is present.

The advantage of NRT data is its fast turnaround time, generally available within 3 hours of observations globally. They can be utilized in regional weather forecast models as well as in support of field campaigns. For the Guide Documents of all AIRS Products, please refer to the [AIRS documentation page](#). The differences between the AIRS NRT and Routine products are described a [memo](#).

Table 9 AIRS NRT Products

Product Short Name	Product Type Filename String	Description
Level 1 Products		
AIRIBRAD_NRT	AIRS_Rad	AIRS IR geolocated & calibrated radiances
AIRABRAD_NRT	AMSU_Rad	AMSU-A1 & AMSU-A2 geolocated, & Calibrated brightness temperatures
AIRVBRAD_NRT	VIS_Rad	AIRS Vis/Near IR geolocated and calibrated radiances
AIRIBQAP_NRT	AIRS_QaSub	AIRS IR quality assurance subset
AIRVBQAP_NRT	VIS_QaSub	AIRS Vis/Near IR quality assurance subset
Level 2 Products		

AIRX2RET_NRT	RetStd	Level-2 retrieval product crated using AIRS IR, AMSU without-HSB
AIRX2SUP_NRT	RetSup	Level-2 retrieval support product created using AIRS IR, AMSU without-HSB
AIRI2CCF_NRT	CC	Level-2 cloud cleared radiance product created using AIRS IR, AMSU without-HSB
Other Products		
AIRXAMAP	GranuleMap	Daily maps that show the locations of the AIRS Level 1 and Level 2 granules

AIRS CO2 Products

The AIRS V6 carbon dioxide Level 2 and Level 3 products will be described in the AIRS Version 6 Tropospheric CO_2 Products on the [Version 6 Documentation page](#) (Note: These products have not yet been released). The Level 2 products will have different spatial resolution than other AIRS Level 2 products. The spatial resolution of the AIRS CO2 Level 2 products is ~ 90 km x 90 km so the files have dimensions of 15 x 22. The V5 CO_2 Level 3 files have 2 degree latitude x 2.5 degree longitude grid boxes (dimensions of those files are 91 degrees latitude x 144 degrees longitude), but the future V6 CO2 Level 3 files will have the same 1°x1° gridding scheme as the other AIRS Level 3 products. The shortnames of the AIRS CO2 products are listed in Table 10.

Table 10 AIRS CO2 Products

Product Short Name	Product Type Filename String	Description
Level 2 Products		
AIRX2STC	CO2_Std	AIRS/Aqua Level 2 Carbon Dioxide (**CO2**) Standard Products (AIRS+AMSU)
AIRX2SPC	CO2_Sup	AIRS/Aqua Level 2 Carbon Dioxide (**CO2**) Support Products (AIRS+AMSU)
Level 3 Products		
AIRX3C2D	CO2Std001	AIRS CO2 Daily Level 3 files
AIRX3C28	CO2Std008	AIRS CO2 Eight Day Level 3 files
AIRX3C2M	CO2Std028 to CO2Std031 (depending upon the month)	AIRS CO2 Monthly Level 3 files

Aqua AIRS Level 2G Precipitation Estimate

The precipitation estimate from the AIRS Level 2 Support product" is combined into one daily "Level 2G" global grid with dimensions (24x1440x720). The short name is "AIRG2SSD" and the filename string is "L2G.Precip_Est." Every hour is a "layer" in the daily file, and the resulting spatial grid cell size is 0.25 degree (~25 km).   Thus the grid size is made to fit TRMM products. Since the AIRS precipitation is retrieved at the AMSU footprint resolution, which is about 45 km at nadir, many cells in this 0.25-deg grid are empty. The data are stored such that the first line is the South Pole. The geolocation information for every hour-layer is also provided in the file.

Further information about this product can be found at the [GCMD](#).

Data Organization

Granularity

Level 1 and Level 2

The AIRS Level 1 and Level 2 data (with the exception of the AIRXBCAL) are broken into a series of 6-minute granules and each granule is a file. Each file contains all observations of a given type made during a period of exactly 6 minutes. For every day there are 240 granules, numbered 1-240. Over the course of 6 minutes the EOS-Aqua platform travels approximately 1500 km, and the AIRS-suite instruments scan a swath approximately 1650 km wide (extending ±49.5° to either side of nadir).

Start times of granules are keyed to the start of 1958. Because of leap seconds, they do not start at the same time as days do. For data from launch through December-31-2005, granule 1 spans 00:05:26 UTC - 00:11:26 UTC and granule 240 starts at 23:59:26 UTC and ends at 00:05:26 UTC the next day. For data December-31-2005 through the next leap second, granule 1 spans 00:05:25 UTC - 00:11:25 UTC and granule 240 starts at 23:59:25 UTC and ends at 00:05:25 UTC the next day.

Level 3

Users of AIRS Level 3 products should be aware that the temporal span of Level 3 daily files is not midnight-to-midnight. The data proceeds in time from left (-180.0°) to right (180.0°) with neighboring cells of data no more than a swath of time apart. This ensures that data points in a grid box are always coincident in time, if the data were gridded using a midnight-to-midnight time scheme, the start of the day and the end of the day would be in the same grid cell, producing an artificial time discontinuity across the grid. The edges of the AIRS Level 3 cells are at the date line (the 180E/W longitude boundary). When plotted, this produces a map with 0 degrees longitude in the center of the image. This method sometimes called a "Data Day" is preferred because the left side of the grid and the right side of the grid contain data farthest apart in time. The method used is analogous to that used to create TOVS Pathfinder level 3 products.

Each Level 3 daily product contains information for a temporal period of 24 hours for either the descending or ascending orbit (rather than midnight-to-midnight) where "ascending or descending" refers to the direction of movement of the sub-satellite point in the satellite track at the equatorial crossing. The ascending direction of movement is from Southern Hemisphere to Northern Hemisphere, with an equatorial crossing time of 1:30 PM local time; the descending direction of movement is from Northern Hemisphere to Southern Hemisphere, with an equatorial crossing time of 1:30 AM local time. Outside of the polar zones, these correspond respectively to daytime and nighttime.

The 5-day (L3 Quantization), 8-day, and Monthly level 3 files follow the same "Data Day" definition as the daily files but over longer time periods.

Filenaming Convention

The AIRS product files are named in accordance to the following convention:

AIRS.*yyyy***.***mm***.***dd***.***ggg***.***Lev***.***productType***.v***m.m.r.b***.G***productionTimeStamp***.hdf**

Where:

- o yyyy = 4 digit year number [2002 -].

- o mm = 2 digit month number [01-12]

- o dd = day of month [01-31]

- o ggg = granule number [1-240] the ".ggg" only applies to Level 1 and Level 2 data. Level 3 data do not have this field

- o Lev= processing level ["L1A","L1B","L1C","L2", or "L3"]

- o productType: see Product Type strings in Tables from Section 1.

- o m.m.r.b = algorithm version identifier is made up of major version, minor version, release version and build number respectively.

- o productionTimeStamp = file creation time stamp. Starts off with a letter G for GES DISC processing facility, followed by yydddhhmmss.

  - ▪ yy: year number without century;

- ▪ ddd: day of a year [1-366];

- ▪ hhmmss: hours, minutes and seconds UTC time.

Example of a Level 2 standard file name:
AIRS.2012.01.01.001.L2.RetStd.v6.0.7.0.G12328075503.hdf

See Appendix B of File Descriptions for Released Products for more details and examples.

File Format and Structure

AIRS product files are stored in the HDF-EOS2 format. HDF-EOS2 format is an extension of the HDF4 format (developed by NCSA) to meet the needs of EOS data products. These extensions facilitate the creation of Grid, Point and Swath data structures. The AIRS Level 1 and Level 2 products are of the swath type structure while the Level 3 products are of the grid type structure.

More details about each AIRS data type can be found in the AIRS Version 6.0 Processing Files Description.

Data Contents

The contents of all released AIRS data files are described in the **File Descriptions for Released Products**.

Tools and Services

Options for Reading and Viewing AIRS Data
The AIRS Tools page at the GES DISC lists several tools for reading and viewing AIRS data.

AIRS File Subsetting and Format conversion
Tools for subsetting and format conversion are available through Mirador and the Simple Subset Wizard. More on these services is available on the AIRS services page.

More Information

Web resources for AIRS data users:

NASA/JPL:

- AIRS Project Web Site: http://airs.jpl.nasa.gov/

- Ask AIRS Science Questions: http://airs.jpl.nasa.gov/AskAirs/

NASA/GSFC:

- AIRS Data Support Main Page: http://disc.sci.gsfc.nasa.gov/AIRS/

- AIRS Data Access: http://disc.sci.gsfc.nasa.gov/AIRS/data_access.shtml

- AIRS Documentation: http://disc.sci.gsfc.nasa.gov/AIRS/documentation.shtml

- AIRS Products: http://disc.sci.gsfc.nasa.gov/AIRS/data_products.shtml

For further assistance, please use this contact information:

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